HAWAII IBP SYNTHESIS:
6. GENETIC VARIATION AND POPULATION STRUCTURE IN ISLAND SPECIES*

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Evolution is an extremely active process on islands, even in highly isolated archipelagos like Hawai'i and Galapagos. Species formation is frequently exuberant and, in many cases, wholly novel adaptations have developed. At first glance, it seems remarkable that this should be true because it is clear that in many relevant instances the lineage which evolves actively in the islands can be traced ultimately to one or only a few continental founder individuals. Even more founder effects appear to occur as new species are formed within an archipelago. On the surface, this appears to be a system which might deplete genetic variability and thus reduce evolutionary potential. Precise data on genetic variation within island species of Drosophila flies have been accumulating now for about 15 years. Modern methods of analysis of genetic variability (biochemical, chromosomal, and polygenic) have been employed to assay genetic variability in various endemic and introduced species. Virtually without exception, these species have local populations which are fully as polymorphic genetically as those of widespread continental species. Accordingly, such populations are highly competent for adaptive evolution. Most island species, however, have small total populations. Thus, even though the local populations may be rich in genetic variability, the total variability sequestered within continental species is certainly much larger, but this does not appear to be a crucial difference. In high-altitude archipelagos like Hawai'i, many factors promote isolation. The serial isolations to which island populations are subjected have a profound effect on their genetic structure. This is true not only for populations between islands (species formation is by interisland founder effects) but also for local populations within an island or even a volcano.

As long ago as 1932, Sewall Wright proposed that the conditions most favorable for rapid evolutionary change exist within a species which is subdivided into local semi-isolated populations, some of which have quite small effective sizes. Many island species appear to reflect precisely this dispersive type of population structure and this may explain their observed evolutionary momentum.

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* Abstract